

Methane Recovery System and Groundwater Remediation at the City of Helena Landfill

Presentation to
City of Helena Commissioners
February 1999



City of Helena (invasive)
Exd Wtr (con. meas)



- ⇒ Dumping began in late 1800s
- ⇒ Class II Landfill (no hazardous wastes)
- ⇒ 37-acre area
- ⇒ 75 tons/day since early 1970s

Dates of Operation

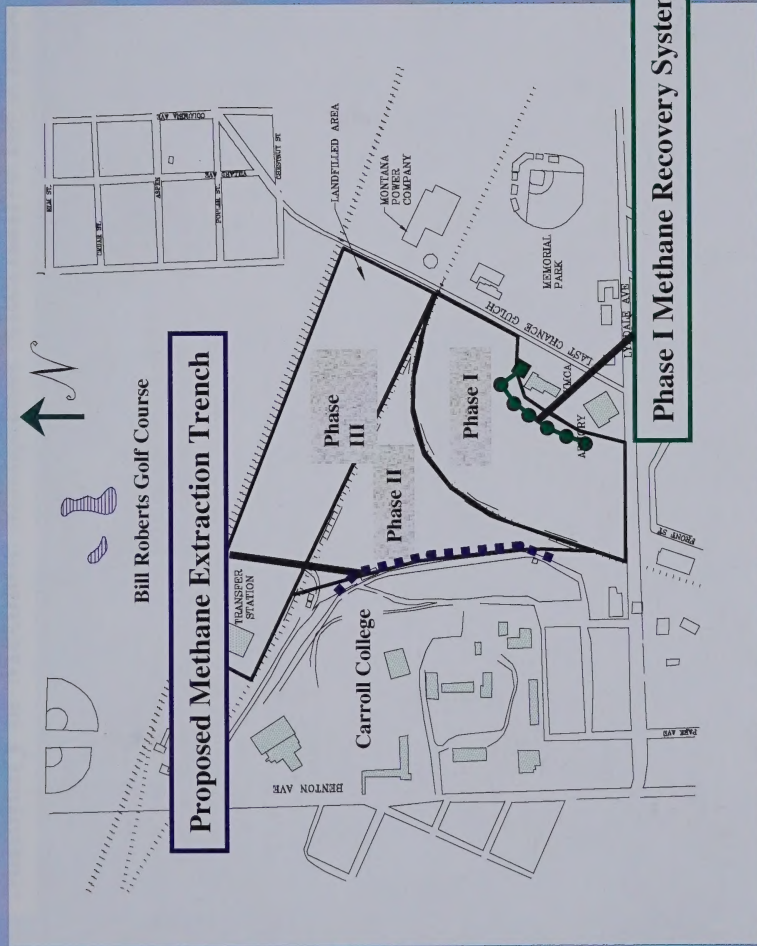
Phase I: Late 1800s - 1979

Phase II: 1979-1983

Phase III: 1983-1994

Helena Landfill -- Location and History





Helena Landfill -- Methane Recovery Systems

FIGURE 2



Figure 1: A schematic diagram of a system.



Figure 2: A schematic diagram of a system.

Figure 3: A schematic diagram of a system.

Summary of Methane Mitigation Alternative for Phase II Area

Alternative	Includes	Present Worth Cost
Alternative 1: Remove all Garbage On Carroll College Property	- Removal of garbage averaging 20 feet deep on approximately 1.6 acres - Disposal in Site E Landfill - Fill Excavation w/local borrow material - Repair/revegetate cover	\$6,426,000
Alternative 2: Passive venting with lateral trench (unlined)	- Excavation of 1500' long trench to bedrock - Backfill with washed gravel - Insert venting pipe - Compaction - Top seal - Replace 18" cover soil - Offgas Treatment with Carbon for odor control	\$124,000
Alternative 3: Passive venting with lateral trench with liner on west side of trench	Same as Alternative 2 but with 20 mil PVC liner on west edge of trench to provide additional barrier to migration.	\$147,000
Alternative 4: Active collection with unlined gas collection trench	Same as Alternative 2 with addition of blower system and required additional piping.	\$257,000
Alternative 5: Active collection with lined gas collection trench	Same as Alternative 3 with addition of blower system and required additional piping	\$280,000
Alternative 6: Active collection with gas extraction wells	- Similar to Phase I system - Eight extraction wells - Four condensate sumps - Offgas treatment with carbon	\$360,000

Notes:

All estimates include present worth analysis of 30-year operation and maintenance

Alternative 1 would likely require additional installation of one of the other alternatives, and no cost for loss of volume in Site E landfill has been determined.

Trenching alternatives assume no entry into trench for pipe placement or trench boxes required.

Trenching alternatives assume City would provide roll-off box, haul excavated material to transfer station and provide for disposal.



Alternative 3 -- Cost Details

Passive Venting w/Lined Gas Collection Trench

Trench Excavation, Backfill, Compaction, Pipe Liner System	\$56,939.33
Vent House	\$16,000.00
<i>Subtotal</i>	\$10,000.00
	\$82,939.33
Mobilization (5%)	\$4,146.97
Engineering and Construction Oversight (15%)	\$12,440.90
Contingencies (20%)	\$16,587.87
Present Worth of Operating Expenses	\$30,740.00
<i>Total</i>	\$146,855.07



Regulations Governing Groundwater Assessment at Landfills

(1) ARM 17.50.708

- Requires groundwater monitoring
- Lists chemicals to be analyzed

If groundwater contamination is detected...

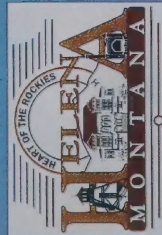
(2) ARM 17.50.710

- Mandates evaluation of corrective measures
- Requires that selected remedial option meets the following objectives:
 - Protect human health and the environment
 - Attain groundwater protection standards
 - Control source area
 - Comply with waste management practices
 - Receive approval from MDEQ





- monitoring well
- △ irrigation well
- domestic water supply well



Groundwater Monitoring at the Helena Landfill

FIGURE 6

Monitoring Program

- ⇒ Semiannual monitoring since 1989
- ⇒ Network of 27 monitoring wells, irrigation wells, domestic water supply wells
- ⇒ Analysis for organic and inorganic compounds as required by ARM 17.50.708

Groundwater Monitoring Results

Flow Direction

**Groundwater flows
to N-NW**



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December 1998 Potentiometric Map

FIGURE 7



- monitoring well
- △ irrigation well
- domestic water supply well

Groundwater Monitoring at the Helena Landfill

FIGURE 8

Compliance Wells

HL-90-1, HL-90-2, MPC-1

Source Area Well

EPA-1



Hydrometrics, Inc.

Consulting Scientists, Engineers, and Contractors

Groundwater Monitoring Results

Chemical Quality

Tetrachloroethylene (also called perchloroethylene or PCE) is the groundwater contaminant of greatest concern

Trends in PCE Concentrations Downgradient of the Helena Landfill

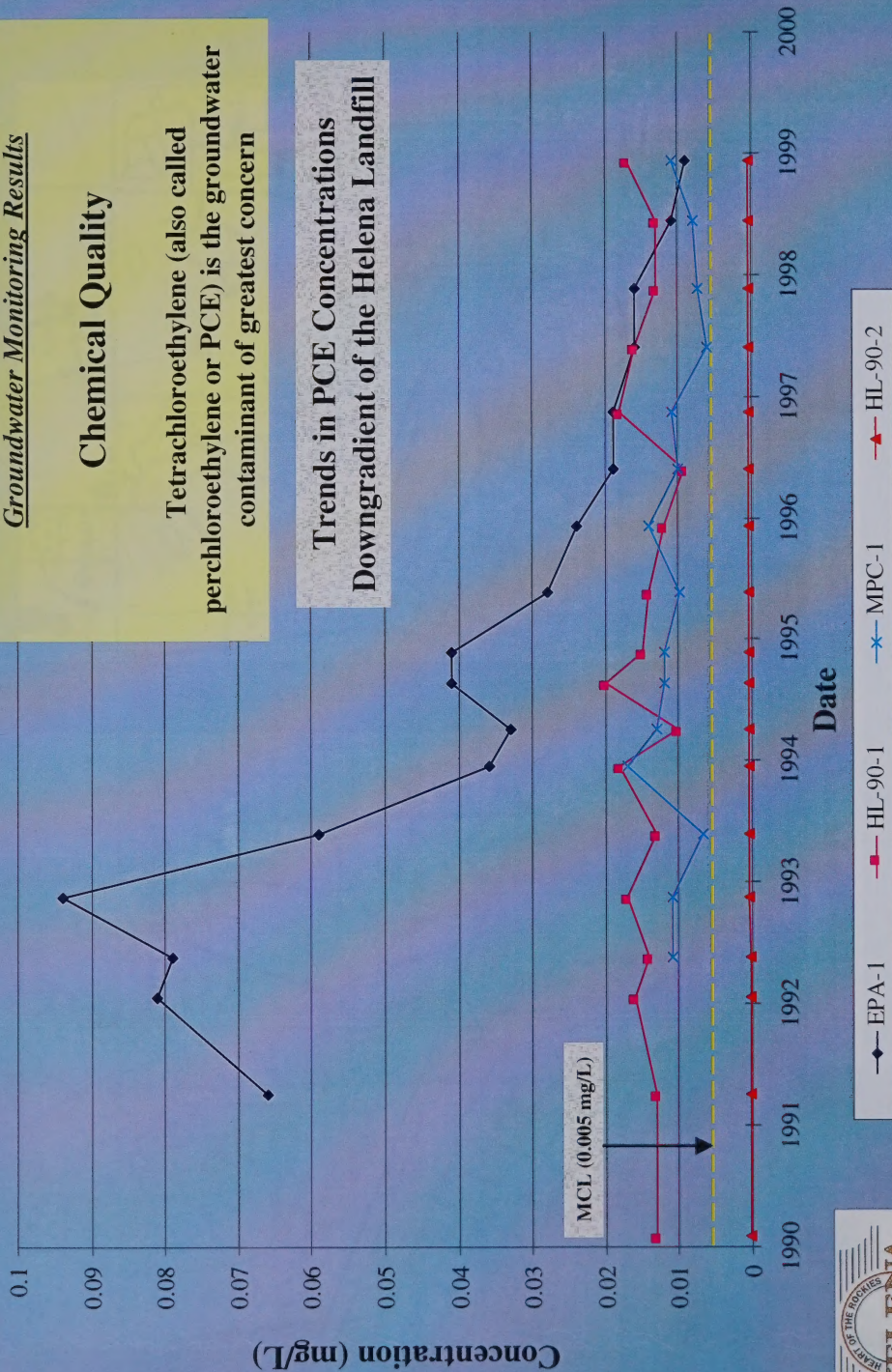
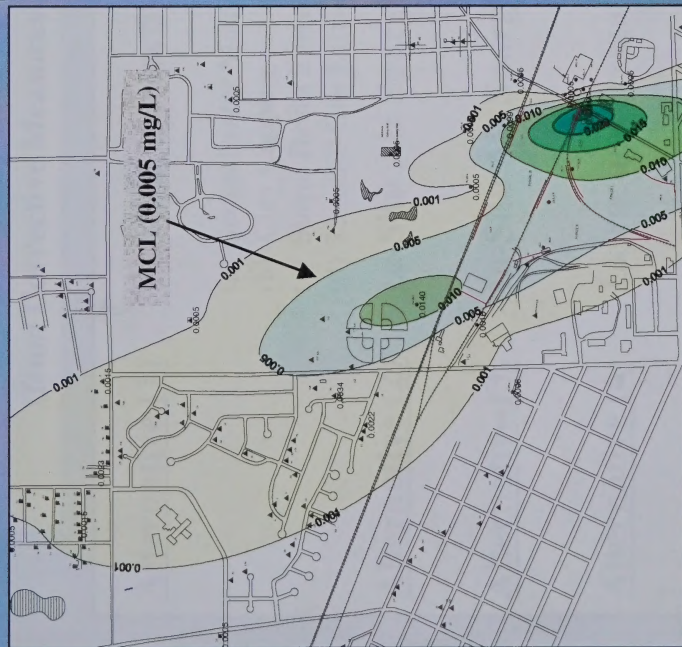
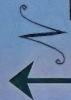


FIGURE 9



May 1995 Data



June 1998 Data

Groundwater PCE Concentrations (mg/L)



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FIGURE 10

Groundwater Remedial Alternatives

(from Corrective Measures Assessment completed in 1995)

<u>Alternative (1)</u>	Existing Corrective Action ☒ (previously implemented)
	(a) Groundwater Monitoring
	(b) Clay Capping
	(c) Storm Drain Extension
	(d) Landfill Gas Extraction
<u>Alternative (2)</u>	In-Situ Air Sparging ☐
<u>Alternative (3)</u>	In-Situ Air Sparging/Soil Gas Extraction ☐
<u>Alternative (4)</u>	Extraction/Irrigation ☒ (preferred alternative) <i>(w/air stripes) Seasonally</i>
<u>Alternative (5)</u>	Extraction/Irrigation/Seasonal Treatment at POTW ☐



Groundwater Modeling

At the request of MDEQ, modeling was conducted to assess the potential effectiveness of groundwater extraction in terms of:

- (1) Reducing concentrations of PCE in groundwater
- (2) Limiting migration of PCE away from the landfill



Groundwater Model Areal Coverage



FIGURE 13



Groundwater Model Flow Paths

particle tracking



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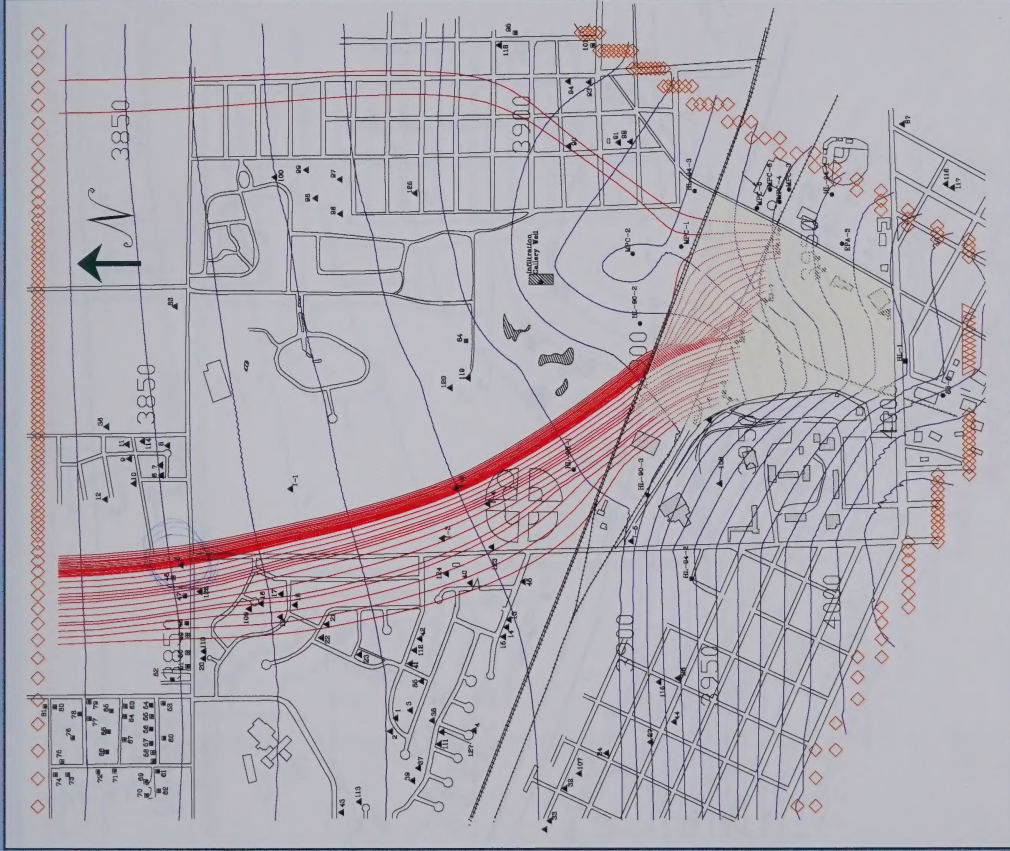


FIGURE 14

Hydrometrics, Inc.

Consulting Scientists, Engineers, and Contractors



Proposed
Capture Wells

Existing
Irrigation Wells

Groundwater Model Pumping Well Locations

FIGURE 15





Proposed
Capture Wells

Existing
Irrigation Wells

Steady State Capture Scenario

FIGURE 16



Proposed
Capture Wells

Existing
Irrigation Wells

180 Day (Seasonal) Pumping Scenario

FIGURE 17





Existing Manhole - Sanitary Sewer Connection

New Irrigation/Pumping Wells

New Irrigation/Water Transport Lines

Phase I: Pilot Testing

Phase II: Full-Scale Implementation

Phase II: Operation & Maintenance

Irrigation Conceptual Design



FIGURE 18

Preliminary Estimated Costs for Implementation of Alternative (4) Extraction/Irrigation

Phase I -- Pilot Testing

**Install Wells, Aquifer Testing, Monitor Groundwater Quality
Estimate \$27,000 for Well Installation and Aquifer Testing**



Phase II -- Full-Scale Implementation

**Install Additional Wells (if necessary), Set Pumps, Construct Irrigation Hookup
Estimate \$135,000 for Full-Scale Installation**



Phase III -- Operation and Maintenance

**Continue Monitoring, Optimize Groundwater Extraction System
Estimate \$50,000 for Annual O&M**



Schedule for Implementation of Alternative (4) Extraction/Irrigation

Phase I -- Pilot Testing
Install Wells, Aquifer Testing, Monitor Groundwater Quality
Summer 1999



Phase II -- Full-Scale Implementation
Install Additional Wells (if necessary), Set Pumps, Construct Irrigation Hookup
Fall 1999 - Spring 2000



Phase III -- Operation and Maintenance
Continue Monitoring, Optimize Groundwater Extraction System
After Full-Scale Implementation



Wants pumping/extraCTION well @ Custer Ave.
still put on golf course

How much wti can you remove/use for
irrigation in a (sole source) aquifer for
the valley?

WANTS TO CLOSE Landfill to "start 30 yr clock."

when? — This will change
mounding location.

quarterly sampling
of compliance wells.

1 well @ Custer shows incr the
↑ (#5)

moved storm wti drainage out.

gas extraction composition not same as in GW →
this gas extraction for safety of Y

close RR spur ~~not safe~~?

* a cap would help gw quality

insitu xferge = "geology too variable" ← but look @
narrow flow path of contain

water golf course also "dilutes" (i.e. could create
* → bday in gw.

DO NOT pump @ MPC-1!

3 west capture wells pumped @ 60-70 gpm

well @ MPC-1, pumped @ 5 gpm

If run only 180 days (NOT 365 da):

lose 30% of contain when wells
not pumping

Winter → make snow

* What if pumping incr concentrations? (at least initially)
sampling schedule

sample even during Pilot Tests.

If Pilot Tests don't work - still have this info

Pilot Test Wells 120' deep - (lots of screen?)

How long will "system" take to decr. conc to MCL @
RPOC.

3 wells to test geology ~~at~~ "variable"

